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Applying What You Have Learned

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Abstract
Last April, a group of over 110 students presented their Capstone projects in the Department of Agricultural and Biosystems Engineering at Iowa State University. The Capstone program serves students in engineering and technology and is a required component of all ABE undergraduates. Capstone programs in engineering and technology are divided into two phases: a first-semester focus on defining the scope of the problem, and an emphasis on solution development and evaluation in the second semester. At the end of the first semester, the teams present their accomplishments at a poster session, where they receive feedback from ABE faculty and industry clients. They return to the second component of their projects with new ideas and a sharper focus on potential solutions.

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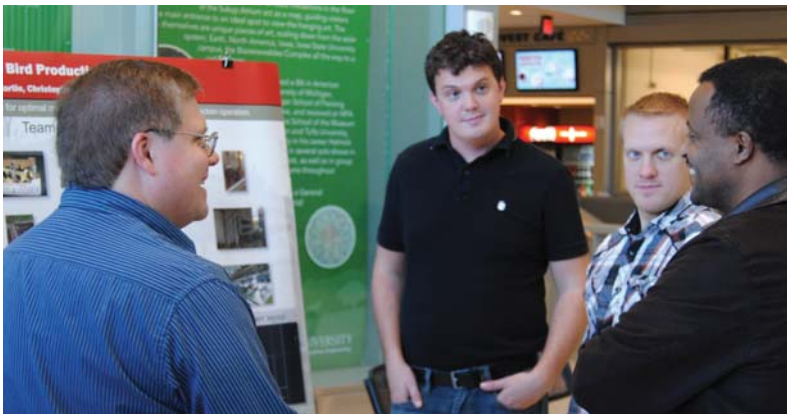
Last April, a group of over 110 students presented their Capstone projects in the Department of Agricultural and Biosystems Engineering at Iowa State University. The Capstone program serves students in engineering and technology and is a required component of all ABE undergraduates. Capstone programs in engineering and technology are divided into two phases: a first-semester focus on defining the scope of the problem, and an emphasis on solution development and evaluation in the second semester. At the end of the first semester, the teams present their accomplishments at a poster session, where they receive feedback from ABE faculty and industry clients. They return to the second component of their projects with new ideas and a sharper focus on potential solutions.

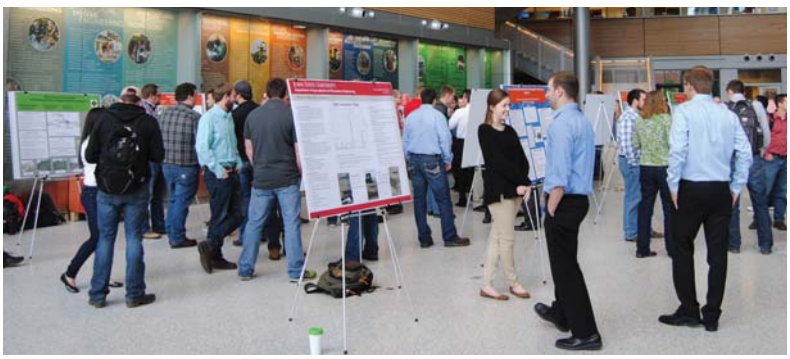
One of us, Norman Muzzy, a lecturer in ABE, leads the engineering Capstone program. "Capstone is a team project that is more self-directed," he said, "Making a plan and working the plan are very important. The lack of definition is sometimes frustrating. My goal is that students learn how to struggle with these issues in Capstone. It will prepare them for their professional careers."

The Farming Conservation Project team, composed of agricultural engineering seniors Jace Klein, Dillan Glock, Quenton Schneider, and Alex Martin, evaluated remote sensing maps to determine land characteristics and the most beneficial conservation practices. Their scope changed between semesters after they realized that they were too ambitious in their initial project plans. "First semester, we looked at different conservation practices and applied a site selection process," said Klein. "Based on field characteristics from over 100 fields, including topography and soil type, we examined what conservation practice might best suit them. In the second semester, we worked with a farmer, visiting his field and designing a conservation plan."

The hands-on aspect of the project and interaction with a real client proved valuable. When asked about their favorite part of the Capstone experience, the team members talked about the gratification of seeing their project come together in the end. "We spent the first month trying to see if anyone in our area would be willing to let us work on their field," said Martin, who also serves as 2015-2016 treasurer for ASABE's International Preprofessional Community. Glock agreed, "Going to see the site and how our conservation practice would be implemented was really great."



Assistant professor Mehari Tekeste gives project suggestions to a student team.



Presentation of Capstone projects in the Sukup Atrium at Iowa State University.

Another of us, Gretchen Mosher, an assistant professor in ABE, leads the technology Capstone program. "Our primary learning goal is for the students to apply the content they learned in class and on internships to a practical, unstructured problem in engineering or technology," she said.

A team of technology students, including Ethan Brehm, Rob Hermsen, Brandon Ludwig, and Charlie Rettey, developed a 3D scanning process for tillage sweeps. The team used innovative technologies and specialized computer programming to scan 3D images of tillage sweeps to quantify and visualize the superiority of their client's product. One student saw a real application based on his personal experiences: "I come from a farming background," said Ludwig. "It can be a pain to change the sweeps every year, sometimes twice a year, so I see the benefit of learning more about it and being able to prove that the proposed solution would require fewer change-outs."

The most enjoyable, yet most frustrating, component of the project was learning different aspects of the scanning technology. "To learn the software takes time, and you have to be willing to put in that time," said Retty. The students also learned that clear communication with their client clarified expectations and ensured that everyone was on the same page. Strong communication also facilitated the team's connection to project resources. Hermsen stated that knowing the location of resources and who to talk to were keys to keeping the project moving.

Even though the two projects differed in approach, tools, and end products, both teams emphasized the importance of time management and clear communication as critical for success in the Capstone program. "There is so much going on senior year. Your team must find time to meet together, and then you have to find time to talk with the client. It can be a struggle," said Klein. The technology team added that it was important to ask questions. "You can't be afraid to ask your client questions. And be persistent when looking for answers," said Ludwig.